Remarks

Favorable reconsideration is requested in view of the above amendments and following remarks. Claims 9-21 have been cancelled. Minor clarifying amendments have been made to claims 1 and 4. No new matter has been entered. Claims 1-8 and 22 are pending in the application.

Restriction Requirement

Applicants confirm the election of Group I, claims 1-8 and 22 without traverse. Claims 9-21 have been cancelled.

Drawings

The drawings have been objected to under 37 C.F.R. § 1.83(a), for not showing every feature specified in the claims.

The conductive regions between the first and second IDT electrodes are metals 203 or doping regions 211a. Thus, the conductive regions are shown in the drawings.

Applicants propose to correct Figures 11A and 11B to include arrows indicating the flow of the tunnel current. Submitted herewith are marked copies of Figures 11A and 11B showing the proposed corrections in red ink. These corrections are supported, for example, at page 5, 6, and 19 as noted above. Upon approval, Applicants will submit a new set of formal drawings reflecting the corrections.

Rejection under 35 USC 112

Claims 3, 4, and 7 have been rejected under 35 USC 112, second paragraph, as being indefinite. This rejection is respectfully traversed.

In rejecting claim 3, the rejection appears to question how a comparison can be made between the doping region and the inner portion of the substrate. Additionally, the rejection appears to inquire as to what are the resistances of the substrate and the doping material, respectively.

There are several examples pertaining to how doping causes a substrate to have a lower resistance. For example, a doping region may have a lower resistance when doping generates lattice defects in crystals constituting a piezoelectric substrate resulting in a hopping current

flowing via a defect level based on those lattice defects. Additionally, the doping region may have a lower resistance when doping leads to the formation of a compound having a low resistivity. For example, the doping region has a lower resistance when a piezoelectric substrate containing Ta is doped with nitrogen resulting in Ta_2N (resistivity: 1.35×10^{-4} Ωcm). Finally, a doping region may have a lower resistance when the substrate is doped with a metallic element having electrical conductivity.

As demonstrated by the above examples, Applicants submit that those skilled in the art would have no difficulty understanding the idea of a doping region having a lower resistance than another portion of a substrate. Therefore, claim 3 is not indefinite. Applicants believe claim 3 to be in condition for allowance.

Claim 4 has been cited by the rejection for using the notation Ω/□. Claim 4 is directed to the sheet resistance of the doping region and has been amended to recite wherein a sheet resistance of the doping region ranges from 10^8Ω/square to 10^{15}Ω/square. Applicants believe that this is a conventional notation, and claim 4 is in condition for allowance.

Finally, in rejection claim 7, the rejection questions how is it possible to have such a thin insulating layer with such a high resistivity.

A thin insulating layer can be formed by doping IDT electrodes with impurities using various doping methods (page 14, lines 12-16). A particularly thin insulating layer can be formed by nitriding or oxidizing the surface of the IDT electrodes using a plasma doping technique.

Claim 7 recites that the resistivity of the insulating layer is not less than 10^6 Ω cm. Resistivity is a value intrinsic to a substance and is not dependent on the thickness of the layer. Thus, an insulating layer having an average thickness of 2 nm to 500 nm and a resistivity of not less than 10^6 Ω cm is possible. Applicants believe claim 7 to be in condition for allowance.

Favorable reconsideration of the rejection to claims 3, 4, and 7 is respectfully requested.

Rejections under 35 USC 102

Claims 1, 6, 8, and 22 have been rejected under 35 USC 102(b) as being anticipated by Sugai. This rejection is respectfully traversed.

Claim 1 is directed to a surface acoustic wave device and requires that the piezoelectric substrate include a doping region. The doping region is positioned between the first and second interdigital transducers (claim 1, lines 7-8). As a result of its position, the doping region suppresses discharge between the first and second interdigital transducers (page 3, lines 21-23).

Sugai discloses an AlN layer (2) corresponding to the piezoelectric substrate of the instant invention and transducers (7) corresponding to the first and interdigital transducers. However, in contrast to the piezoelectric substrate as claimed by the instant invention, the AlN layer (2) of Sugai does not include a doping region.

Figure 1 is a perspective view of the SAW device disclosed by Sugai. Figure 2 is a detailed cross-section of the Schottky diode (9) provided in the silicon oxide layer (4) of the SAW device.

As illustrated by Figure 1, Sugai teaches that the doped layers 5 or 6 are formed as separate layers from both the AlN layer (2) and the transducers (7). Figure 1 shows that the doped layers (5) and (6) are provided on the sapphire single crystal layer substrate (1) as adjacent layers to the AlN (2) layer. Additionally, neither of the doped layers (5) or (6) is positioned between the first and second transducers (7).

Claim 6 requires that the first and second interdigital transducers be provided with an insulating layer on the surfaces thereof. Claim 8, recites that the insulating layer is made of a metal nitride or a metal oxide. In contrast to the claimed invention, Sugai discloses that a silicon oxide layer is provided on the doped layer 5 (col. 2, lines 54-55). Contrary to the assertion made by the rejection, Sugai does not teach or suggest an insulating layer provided on the transducers (7).

As demonstrated above, Sugai fails to teach or suggest each and every limitation of claims 1, 6 and 8 and, as such, fails to anticipate the device as claimed by the instant invention. Dependent claim 22 is also patentable for at least those same reasons mentioned above. Favorable reconsideration is respectfully requested.

Claim 2 has been rejected under 35 USC 103(a) as being unpatentable over Sugai in view of ordinary skill in the art. This rejection is respectfully traversed.

Sugai does not teach or suggest that the piezoelectric substrate includes a doping region, as required by instant claim 1. As shown in Figure 1, Sugai discloses that the doped layers 5 and 6 are provided on the sapphire single-crystal substrate (1) as separate layers from the ALN layer (2). Thus, even if the doped layers 5 and 6 had a depth of no more than 50 nm, Sugai in view of ordinary skill in the art fails to render claim 2 obvious, as Sugai fails to teach or suggest that either of the doped layers 5 and 6 are included by the AlN (2) layer.

Thus, for the reasons discussed above, dependent claim 2 is patentable over Sugai in view of the ordinary skill in the art. Favorable reconsideration is respectfully requested.

Claim 5

The Examiner has indicated that claim 5 has not been considered, as the Examiner considers the method of making the device not pertinent to the issue of patentability. Applicants respectfully assert that claim 5 is patentable for at least the reasons that it depends from claim 1 and request consideration of the claim.

Conclusion

In view of the above, favorable reconsideration is respectfully requested in the form of a Notice of Allowance.

Respectfully Submitted,

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